

COURSE OUTLINE

(1) GENERAL

SCHOOL	UNIVERSITY OF THESSALY		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΥΔ0400	SEMESTER	7th
COURSE TITLE	COMPUTATIONAL HYDRAULICS WITH APPLICATIONS IN HYDRAULIC WORKS		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
		4	6
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i>	Specialized general knowledge, skills development		
PREREQUISITE COURSES:	Fluid Mechanics Hydraulics Computer Programming Numerical Analysis		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)			

(2) LEARNING OUTCOMES

Learning outcomes <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i> <i>Consult Appendix A</i> • Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area • Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B • Guidelines for writing Learning Outcomes
Specific Knowledge Upon completing the course, the student will become familiar with the application of computational algorithms in solving Fluid Mechanics and Hydraulics problems, conducting hydrological and hydraulic studies, and designing hydraulic structures.
Skills and Competencies Upon completing the course, the student will gain proficiency in developing basic algorithms, programming these algorithms in FORTRAN, C/C++ or python, and using packages for Computational Fluid Dynamics, Hydraulics, and Hydrology.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>
<i>Decision-making</i>	<i>Respect for the natural environment</i>
<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Team work</i>	<i>Criticism and self-criticism</i>
<i>Working in an international environment</i>	<i>Production of free, creative and inductive thinking</i>
<i>Working in an interdisciplinary environment</i>	<i>.....</i>
<i>Production of new research ideas</i>	<i>Others...</i>
	<i>.....</i>

- Research, analysis, and synthesis of data and information, utilizing the necessary technologies
- Adaptation to new situations
- Decision-making
- Teamwork
- Project planning
- Generation of new research ideas
- Promotion of free, creative, and inductive thinking
- Respect for the natural environment

(3) SYLLABUS**Week No. – Course conten**

- 1 - Methods of Numerical Data Analysis I: Statistical Analysis
- 2 - Methods of Numerical Data Analysis II: Spectral Analysis
- 3 - The Finite Difference Method
- 4 - Numerical Dispersion and Diffusion
- 5 - Parabolic Flow Equations – Examples
- 6 - Hyperbolic Flow Equations – Examples
- 7 - Elliptic Flow Equations – Examples
- 8 - Applications in Open Channel Flow
- 9 - Applications in Closed Conduit Flow
- 10 - Flow in Pipeline Networks
- 11 - Applications in Groundwater Hydraulics
- 12 - Overview/Use of Numerical Flow Simulation Programs: OpenFOAM, CFX, FLOW-3D, Fluent
- 13 - Introduction to Finite Volume Method
- 14 - Introduction to Spectral Elements

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Power-point, notes, tutorials, exercises, and announcements in e-class.	
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>	<i>Activity</i>	<i>Semester workload</i>
	Lectures	14*4=56 hours
	Study	13*4=52 hours
	Project	40 hours
	Final examinations	2 hours

<i>The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS</i>	Course total	150
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Language of Evaluation Greek Methods of evaluation 50% - Final written examinations 50 % - Class project	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- Χρ. Κουτίτα «Υπολογιστική Υδραυλική», Ξάνθη, 1982
- M.B. Abbott and A.W. Minns, "Computational Hydraulics" Second Edition, Ashgate, 1998.
- C.B. Vreugdenhil "Computational Hydraulics, An Introduction", Springer-Verlag, 1989.
- G.F. Pinder and W.G. Gray, "Finite Element and Simulation in Surface and Subsurface Hydrology", Nelson, London, 1977.
- Chung, T.J. (1978) Finite Element Analysis in Fluid Dynamics. McGraw-Hill, New York.
- Fischer, H.B., E.J. List and R.C.Y. Kon (1979) Mixing in Inland and Coastal Waters. Academic Press.
- Gear, C.W. (1971) Numerical Initial Value Problems in Ordinary Differential Equations. Prentice Hall.
- Peyret, R. and T.D. Taylor (1983) Computational Methods for Fluid Flow. Springer, New York.
- Gear, C.W. (1971) Numerical Initial Value Problems in Ordinary Differential Equations. Prentice Hall.
- Peyret, R. and T.D. Taylor (1983) Computational Methods for Fluid Flow. Springer, New York. Handouts from Greek and international bibliography

- Related academic journals:

- Physis of Fluids,
- Journal of Fluid Mechanics,
- Journal of Hydraulic Research,
- Journal of Hydraulic Engineering,
- Journal of Hydraulics